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Swinford

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(54) **JET MOTOR FOR PROVIDING ROTATION IN A DOWNHOLE TOOL**

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(51) **Int. Cl.**
E21B 4/02 (2006.01)

(52) **U.S. Cl.** **175/107**; 415/903

(58) **Field of Classification Search** 175/107; 415/202, 903, 904
See application file for complete search history.

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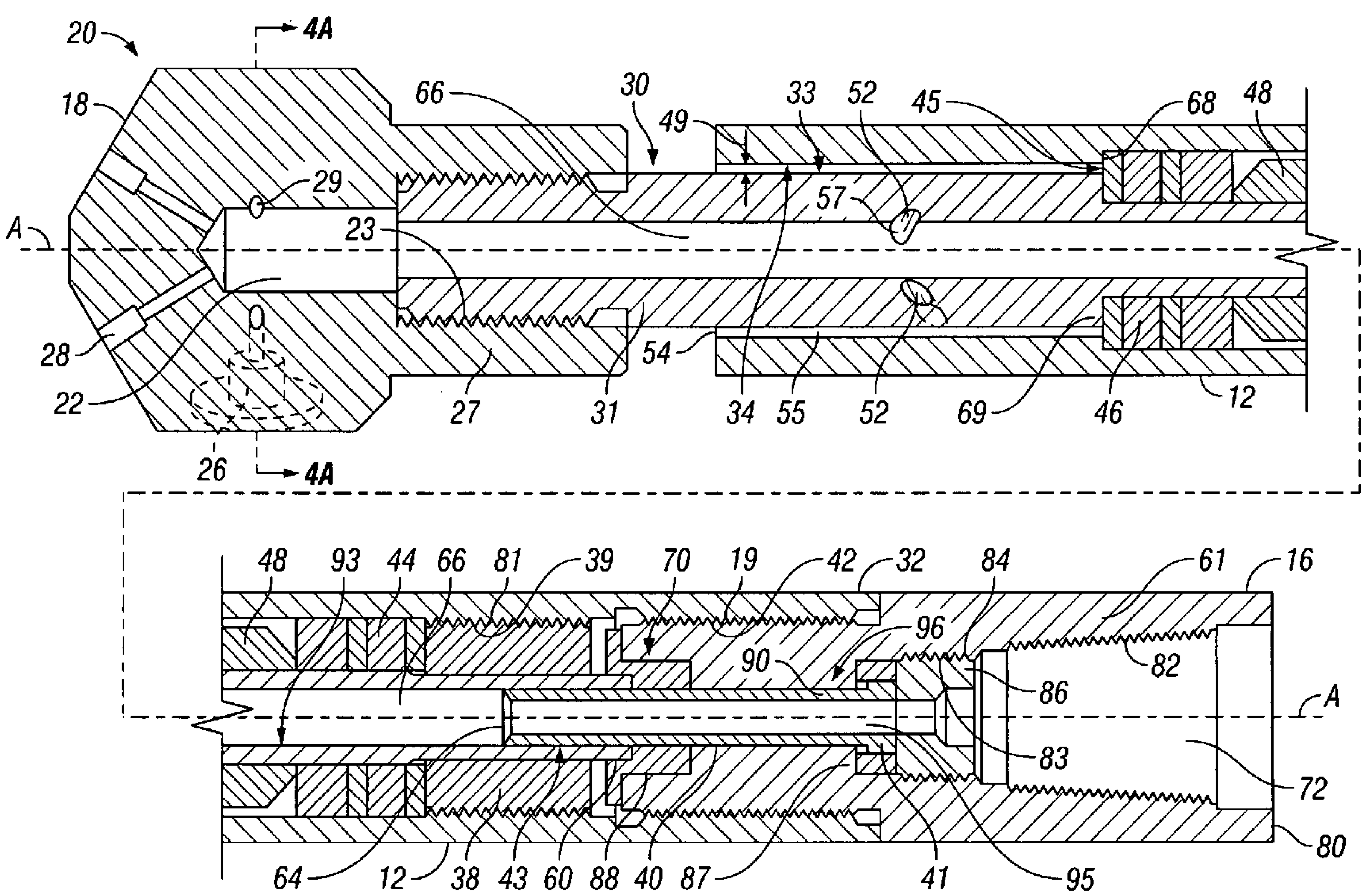
(57) **ABSTRACT**

The invention comprises a downhole jet motor, and a method of using same, that can be utilized to drill or to clean a well bore or tubing. The jet motor comprises a power shaft partially surrounded by a control sleeve defining a blind annular space, closed at the upper end and open at the lower end to allow fluid discharge. At least one opening is provided in the drive shaft wall extending radially within the annulus region. Drilling or cleaning fluid pressure is directed to the at least one opening in the power shaft. The control sleeve provides a reaction structure in relation to fluid discharged from the at least one opening producing rotation of the drive shaft in relation to the control sleeve.

18 Claims, 6 Drawing Sheets



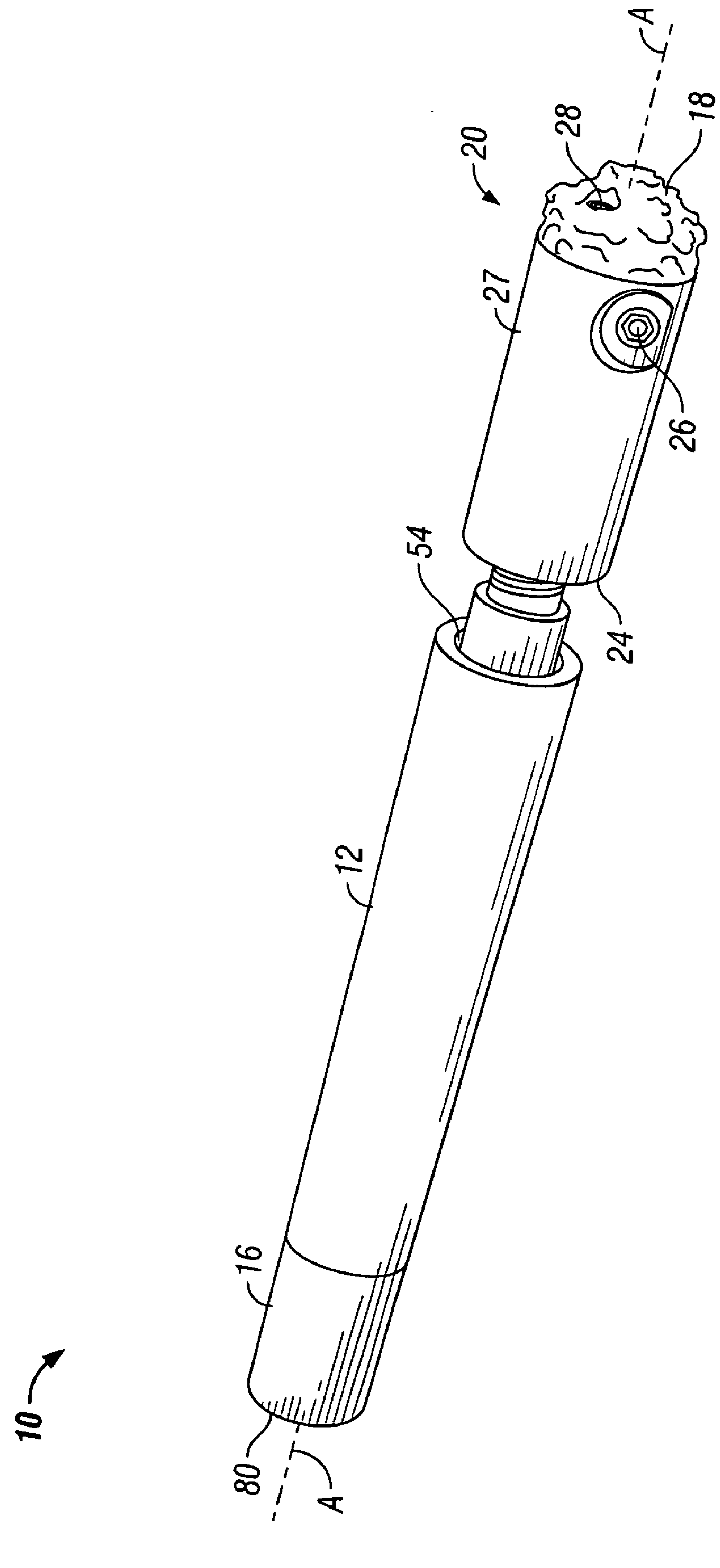


FIG. 1

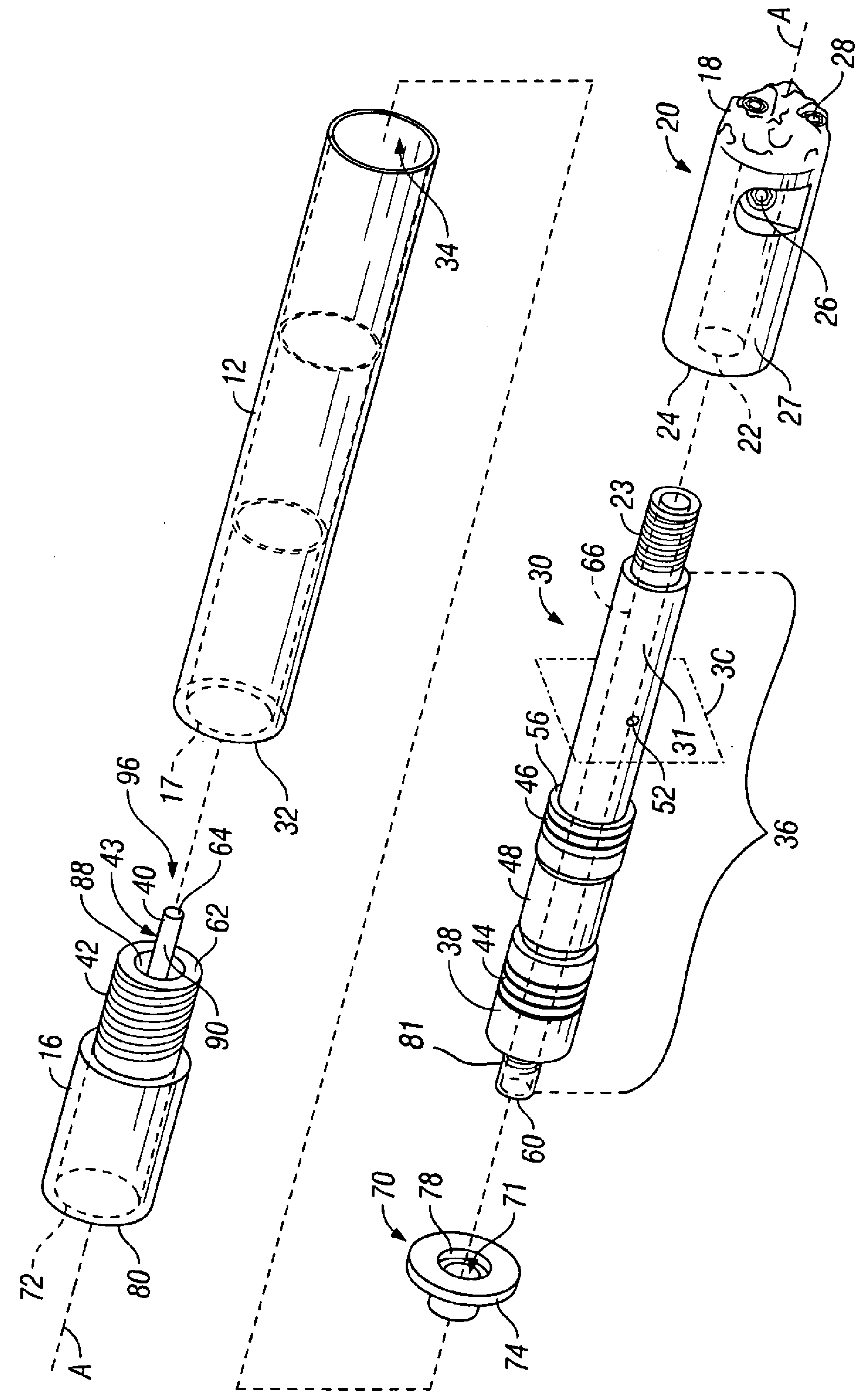

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FIG. 2

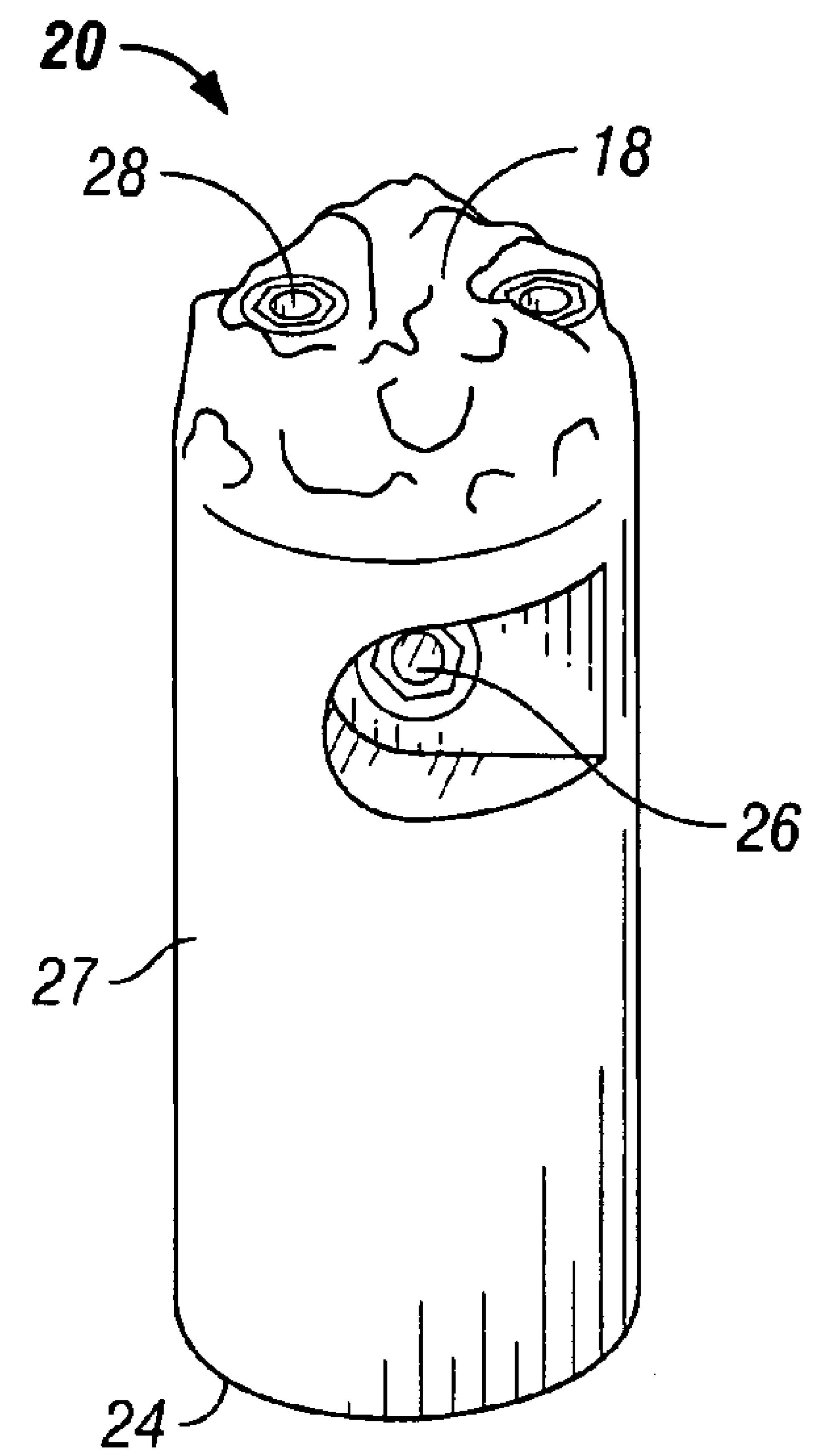

FIG. 3A

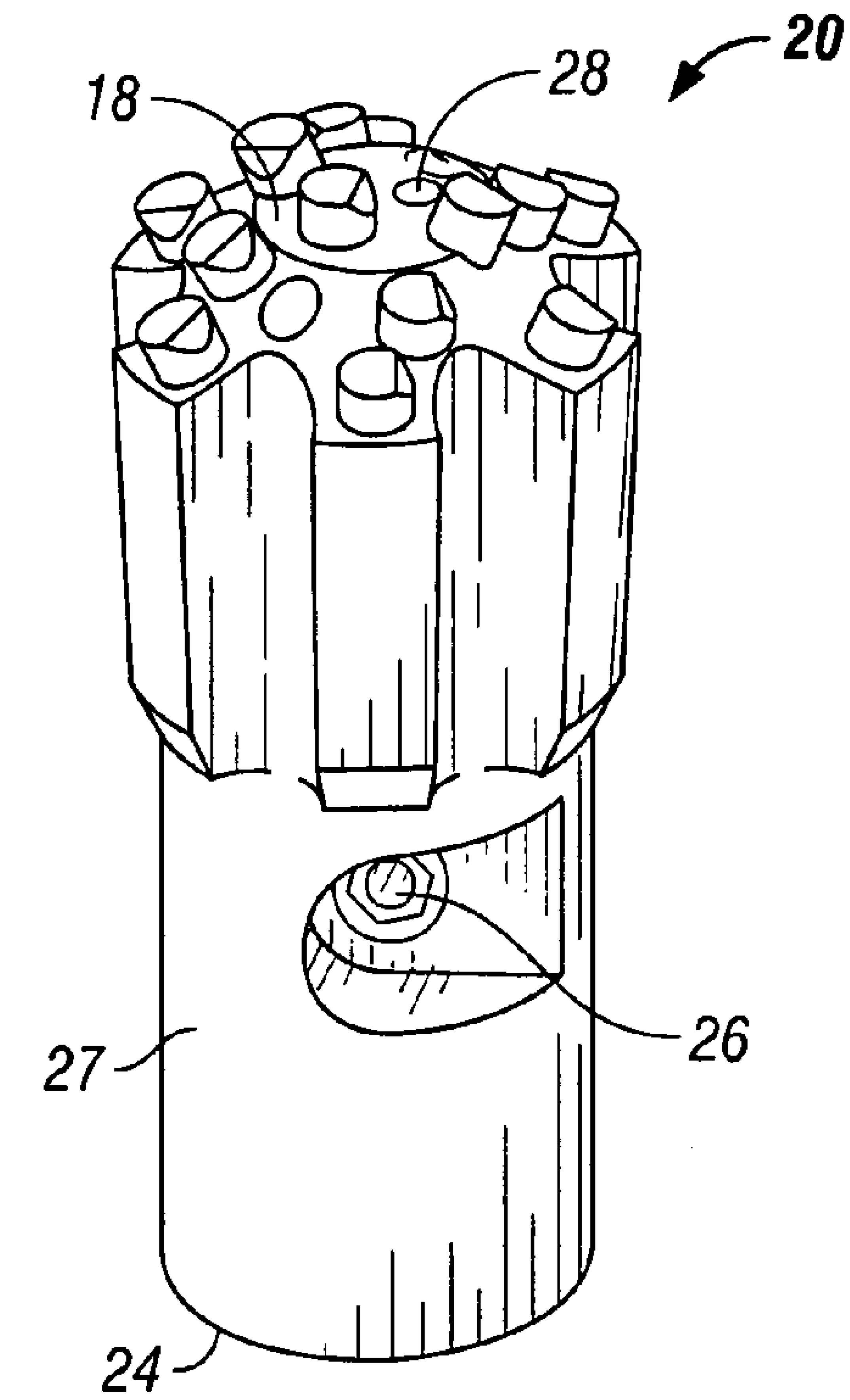

FIG. 3B

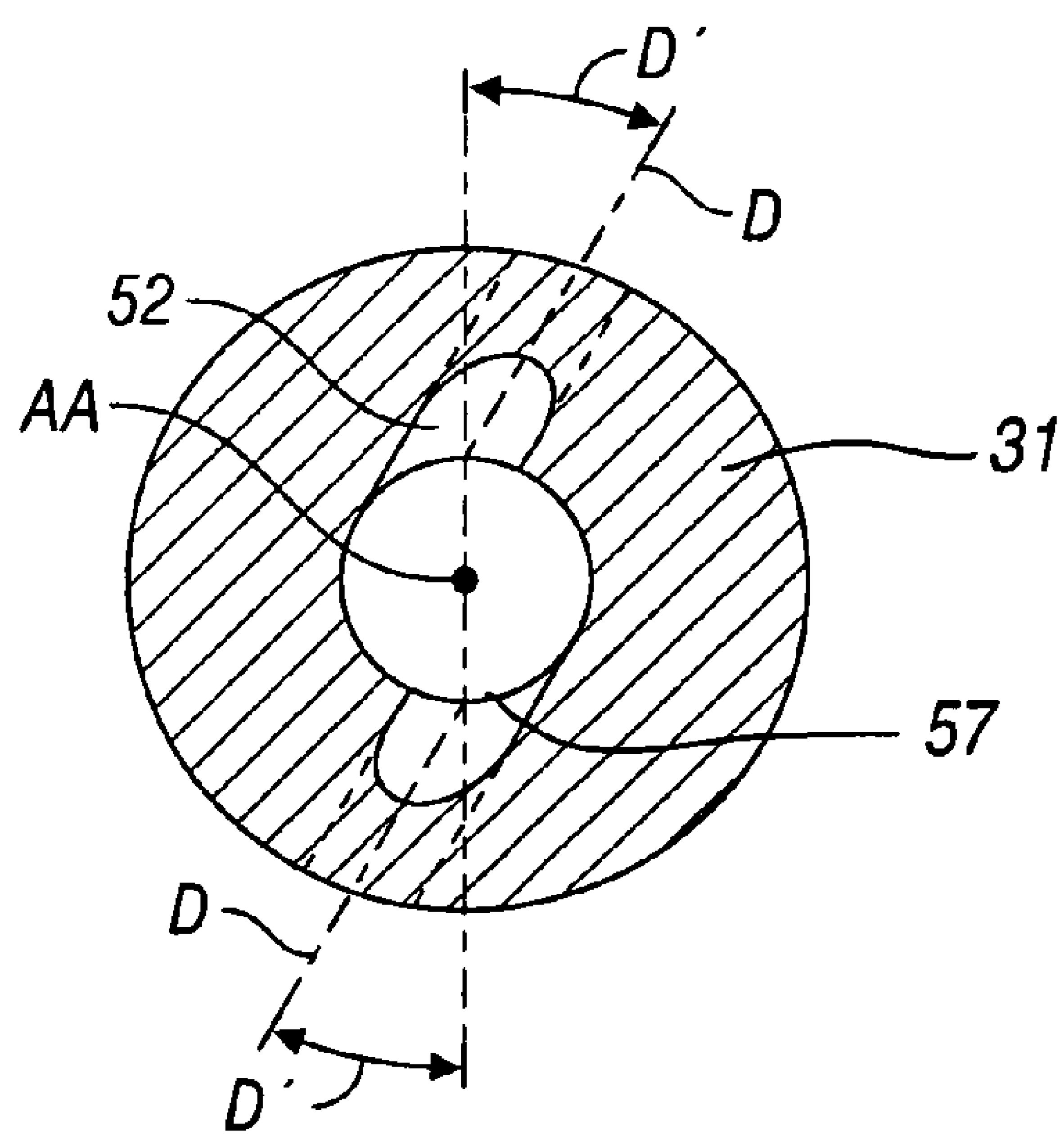

FIG. 3C

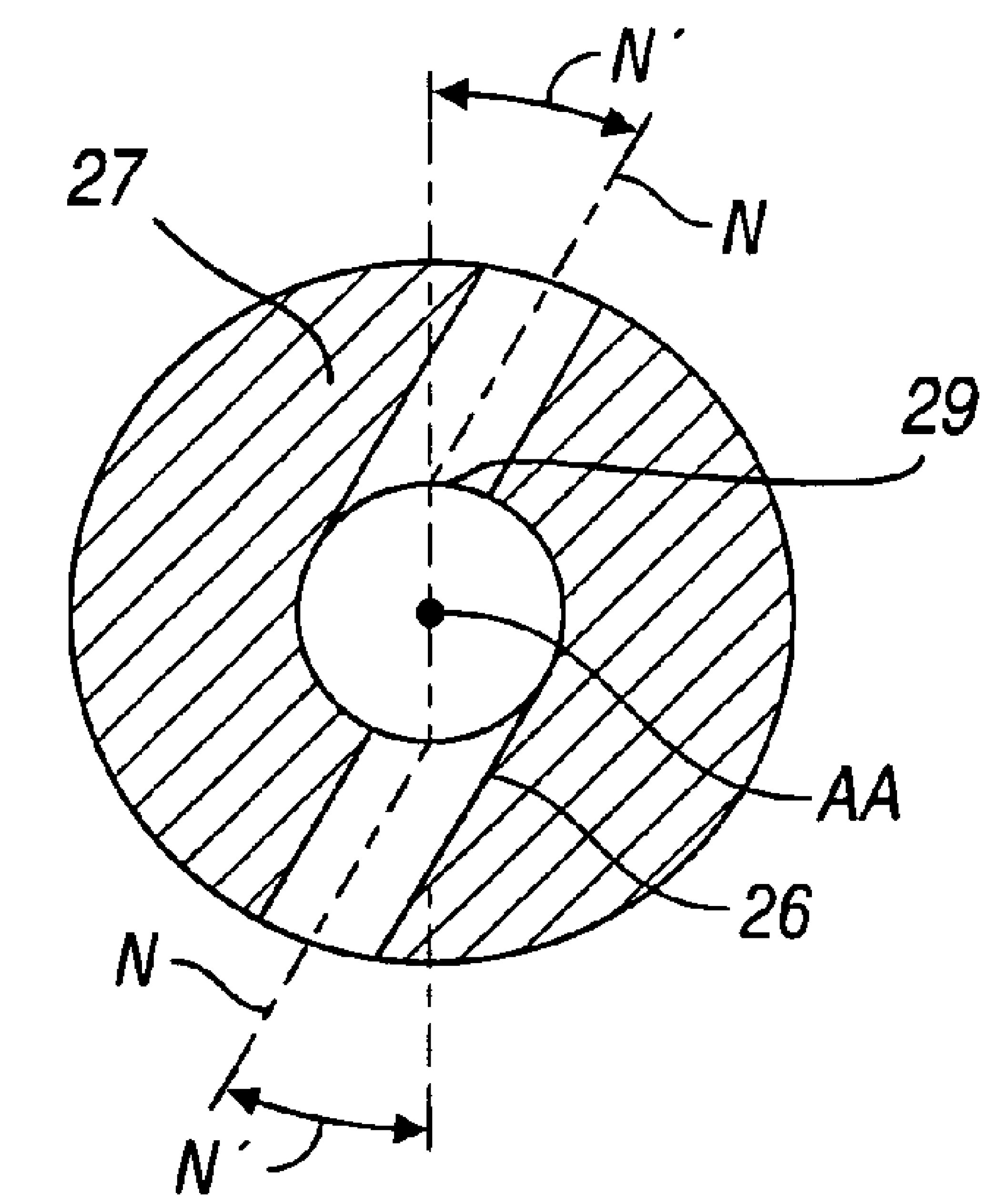

FIG. 4A

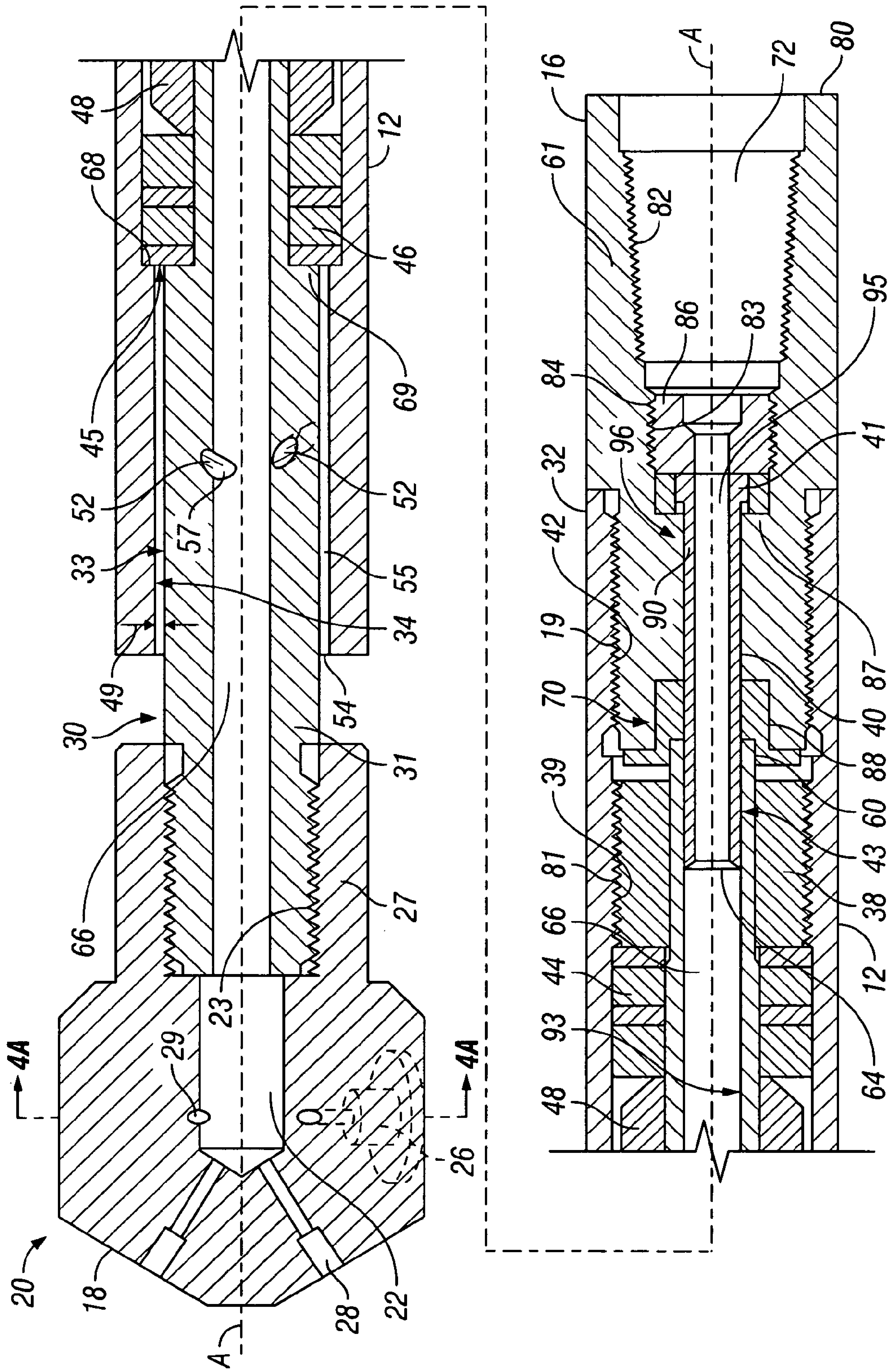
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FIG. 4

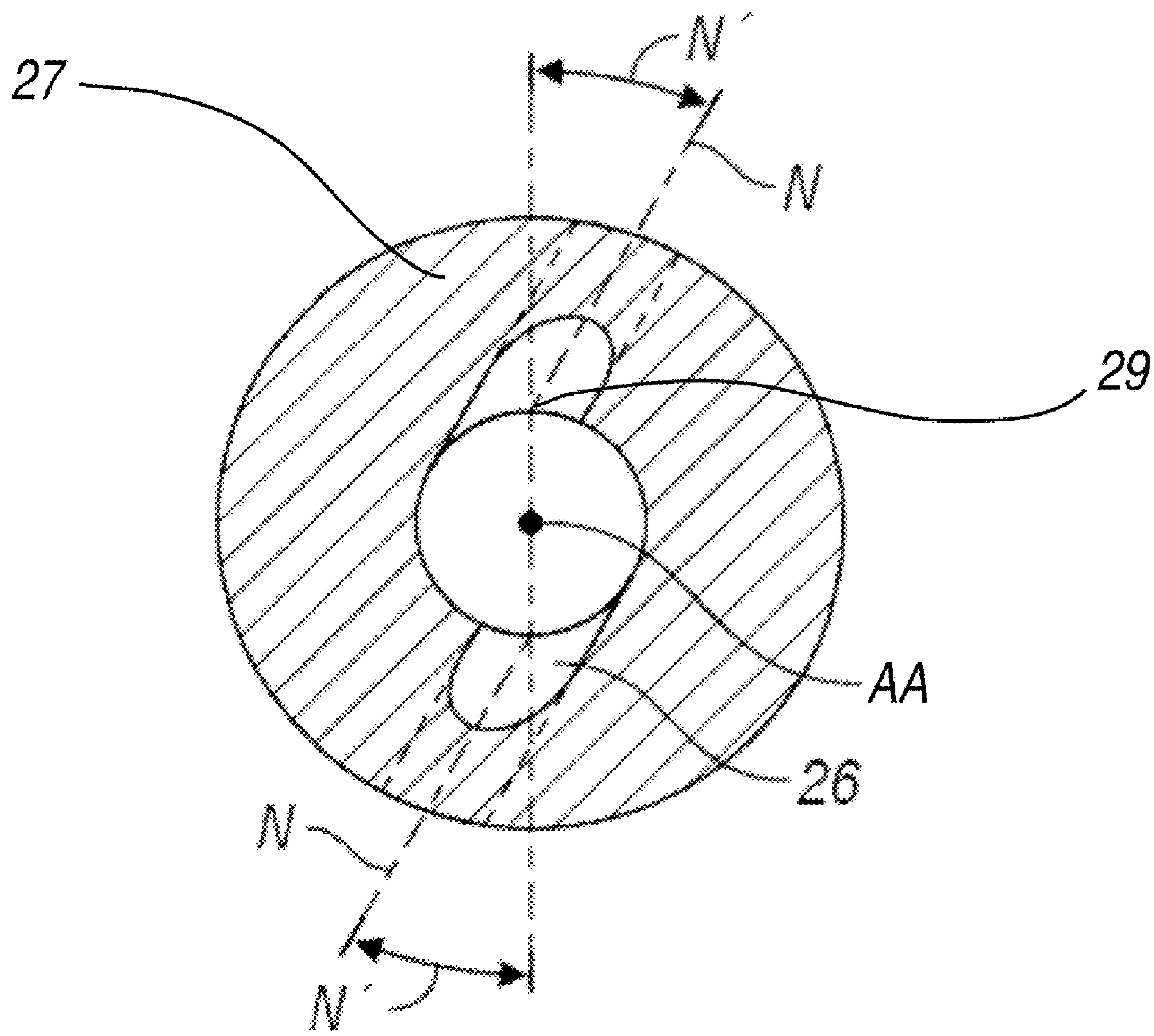

FIG. 4B

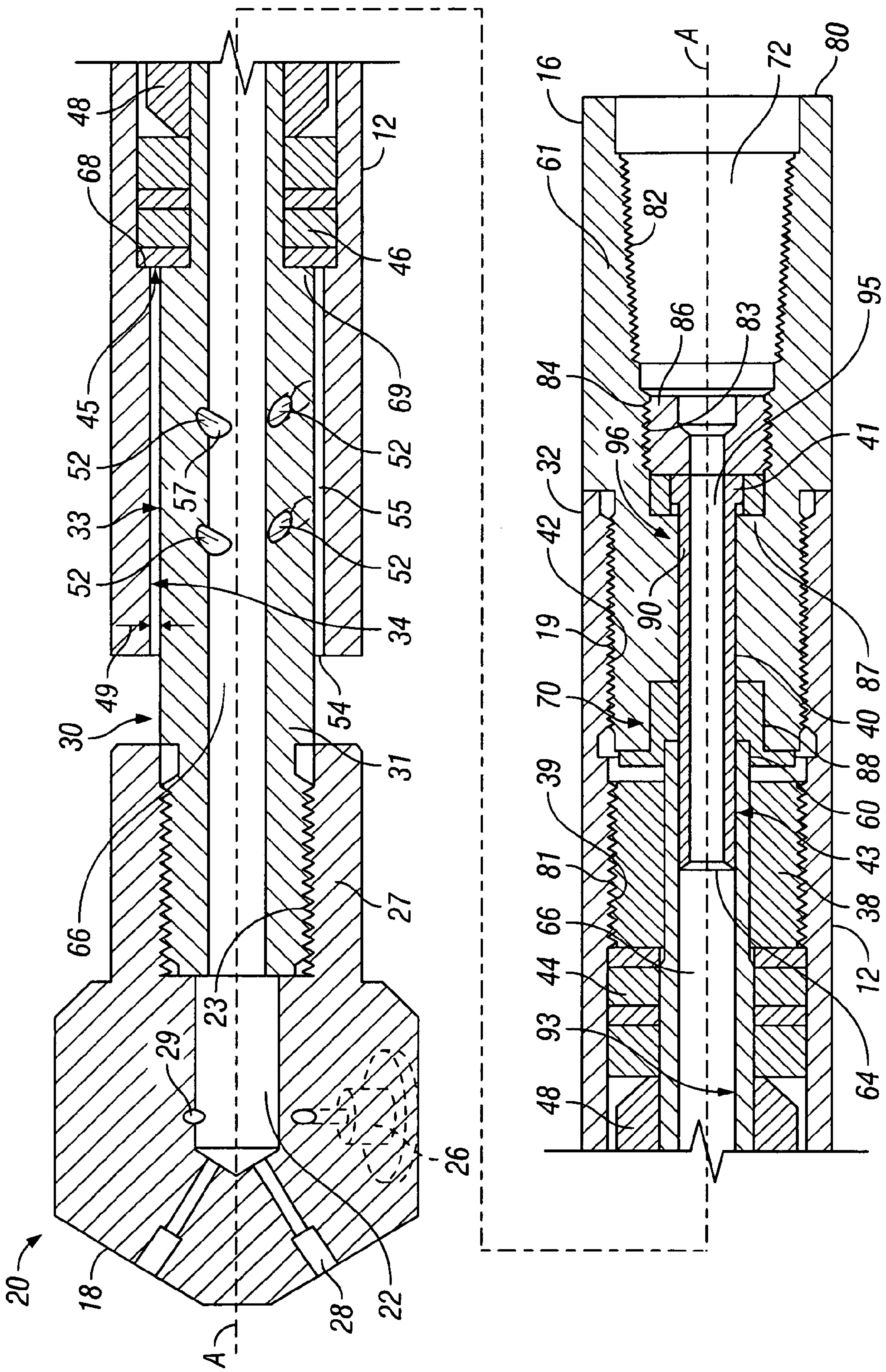

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FIG. 5

JET MOTOR FOR PROVIDING ROTATION IN A DOWNHOLE TOOL

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims the benefit of U.S. Provisional Patent Application No. 60/787,906 entitled, "Downhole Tool," filed on Mar. 31, 2006, in the United States Patent and Trademark Office.

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

Not Applicable.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates in general to a downhole drilling and cleaning apparatus. More specifically, the invention is directed to a motor and apparatus for cleaning out production tubing, for drilling oil and gas wells and like applications.

2. Description of the Related Art

The use of hydraulically driven drill bits is known in the art as described in the following U.S. patents.

U.S. Pat. No. 1,727,276, issued to Diehl on Sep. 3, 1929, discloses a drill bit rotating at one speed and a body portion rotating at a second lower speed. Once the drill bit engages a hard formation the drill bit and the body combine and rotate at the speed of the body portion.

U.S. Pat. No. 1,860,214, issued to Yeaman on May 24, 1932, discloses a hydraulically rotating drill bit with exhaust passages through the bit body for the escape of impelling fluid.

U.S. Pat. No. 3,133,603, issued to Lagacherie, et al on May 19, 1964, discloses a fluid driven-bit wherein fluid passes over an internal turbine. The fluid acts upon the internal turbine in order to rotate the drill bit.

U.S. Pat. No. 3,844,362, issued to Elbert, et al on Oct. 29, 1974, discloses a device for boring holes comprising a body having a front end and a rear end wherein forward drive means are provided at the rear end for receiving pressurized fluid. A boring head is rotatably mounted in the body and projects from the front end of the body. Passages direct fluid from the boring head to impart torque to the boring head.

U.S. Pat. Nos. 4,440,242 and 4,529,046, issued to Schmidt, et al on Apr. 3, 1984 and Jul. 16, 1985 respectively, disclose a drilling apparatus having nozzles functioning as cutting jets and passages discharging radially to generate torque for rotation.

U.S. Pat. No. 5,101,916, issued to Lesh for on Apr. 7, 1992, discloses a fluid-driven tool wherein pressurized fluid is used to create rotation by force applied to internal helical vanes.

U.S. Pat. No. 5,385,407, issued to De Lucia on Jan. 31, 1995, discloses a tool having three sections wherein lubricant is permitted to flow through orifices to lubricate the bearing assembly.

U.S. Pat. No. 6,520,271, issued to Martini on Feb. 18, 2003, discloses a fluid-driven tool wherein pressurized fluid is used to create rotation by internal vanes.

The prior art does not disclose a downhole motor capable of generating rotational and thrust torque with radially-extending nozzles in cooperation with a control sleeve.

The prior art does not disclose a downhole motor capable of generating significant torque utilizing a fluid comprising either a liquid or a gas.

It is a further object of the present invention to provide a downhole drilling and cleaning tool having a plurality of nozzles providing rotational and forward thrust in cooperation with a control sleeve.

BRIEF SUMMARY OF THE INVENTION

The present invention comprises a jet motor downhole tool that can be utilized to drill or to clean a well bore or tubing associated therewith. The jet motor includes a motor comprising drive nozzles at a power shaft generating rotational torque acting in cooperation with a control sleeve. The jet motor connects to an upper member that is in fluid communication with the source of drilling or cleaning fluid. Drilling or cleaning fluid pressure is directed to nozzles in the power shaft extending generally in a radial direction. The nozzles may be oriented at an axial angle obtusely to provide downward force. The power shaft rotates in relation to a control sleeve spaced from the power shaft, the control sleeve providing a reaction structure in relation to fluid discharged from the nozzles. The control sleeve and the power shaft define a blind annular space, closed at the upper end and open at the lower end to allow fluid discharge.

Other features and advantages of the invention will be apparent from the following description, the accompanying drawings and the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a side view of the jet motor as fully assembled.

FIG. **2** is a partial exploded view of the jet motor.

FIG. **3**A is a perspective view of the drill bit of the jet motor.

FIG. **3**B is a perspective view of an alternative embodiment of the drill bit.

FIG. **3**C is a cross-sectional view of the power shaft of the jet motor taken along plane **3**C in FIG. **2**.

FIG. **4** is a cross-sectional view of the jet motor taken along axis A-A in FIG. **1** and through the drive nozzles.

FIG. **4**A is a cross-sectional view of the drill bit taken along line **4**A-**4**A in FIG. **4**.

FIG. **4**B is a cross-sectional view of an alternative embodiment of the drill bit taken through the nozzles.

FIG. **5** is a cross-sectional view of an alternative embodiment of the jet motor.

DESCRIPTION OF THE INVENTION

Referring to FIG. **1**, the exterior of the present invention **10** generally comprises a drill bit **20**, control sleeve **12**, and upper subassembly **16** having a common central longitudinal axis AA.

As used herein, "upper" will refer to the direction of upper end **80** of upper subassembly **16** that connects to a drill string or tubing (not shown). As used herein, "lower" will refer to the direction of the drill face **18** of drill bit **20**.

Referring to FIG. **2**, drill bit **20** is generally a closed cylindrical structure with an open connection end **24**. Channel **22** extends inwardly of bit **20** from connection end **24**. In an exemplary embodiment, threading is provided on the interior surface of drill bit **20** proximate connection end **24** for threaded connection to threaded lower connector **23** of power shaft assembly **36**.

In an exemplary embodiment, drill bit face **18** is textured to model a rock configuration as depicted in FIG. **3**A. Alternatively, drill bit face **18** is comprised of a plurality of nodes, as seen in FIG. **3**B.

At least one rotation nozzle **26** is disposed in cylinder wall **27** of drill bit **20**. In an exemplary embodiment at least two rotation nozzles **26** are provided. Rotation nozzles **26** are in fluid communication with the interior channel **22** of drill bit **20** and allow fluid flow from channel **22** to the exterior of bit **20**.

Referring to FIG. **4**A, nozzles **26** each have an axis NN. Axes NN are each disposed generally perpendicularly to axis AA. Axes NN of the rotation nozzles **26** are each oriented radially to allow fluid expulsion from nozzles **26** to provide rotational thrust in a desired direction. Specifically, the angle N' of each axis NN with respect to a plane passing through axis AA and interior opening **29** of cylinder wall **27** is acute in the preferred direction of rotation.

Referring to FIG. **4**B, in an alternative embodiment, nozzles **26** may each be oriented from a plane normal to axis AA at the interior opening **29** of each nozzle **26** to provide a forward thrust from fluid escaping through nozzles **26**.

Referring to FIGS. **2**, **3** and **4**, cutting nozzles **28** are provided in bit face **18**. Cutting nozzles **28** are in fluid communication with interior channel **22** of drill bit **20**. The axes of cutting nozzles **28** may be oriented parallel with axis AA or at an angle to axis AA. Fluid escaping from nozzles **28** provides cutting forces and washes loose materials away from bit face **18**.

Control sleeve **12** is generally composed of an elongated cylindrical barrel body, with a sleeve channel **17** passing therethrough. Sleeve channel **17** is oriented along axis AA.

Referring to FIG. **4**. control sleeve **12** is provided with threading **19** at its upper end **32** for threaded connection to threaded lower end **42** of upper subassembly **16**. Upper subassembly **16** is provided with threading **82** at its end **80** to allow connection to a drill string or tubing (not shown). Such threaded connections are commonly practiced. Accordingly, control sleeve **12**, after installation on a drill string or tubing, is in a fixed position in relation to the drill string or tubing.

Referring to FIGS. **2** and **4**, power shaft assembly **36** is depicted. Power shaft assembly **36** includes power shaft **30**, lower radial bearing **46**, thrust bushing **48**, upper radial bearing **44**, retainer **38** and upper thrust bushing **70**.

Power shaft **30** comprises a hollow cylinder structure having an internal channel **66** aligned with axis AA. Internal channel **66** allows fluid communication from a drill string or tube (not shown) to channel **22** of drill bit **20**.

Power shaft **30** is constructed and sized to rotate within control sleeve **12** with lower radial bearing **46** and upper radial bearing **44** providing radial support. As drill bit **20** is fixedly attached to power shaft **30**, drill bit **20** and power shaft **30** rotate together in relation to control sleeve **12**.

Thrust bushing **48** extends intermediate lower radial bearing **46** and upper radial bearing **44**.

A retainer nut **38** is provided on power shaft **30** intermediate upper radial bearing **44** and upper end **60** of power shaft **30**. Retainer nut **38** is provided with an internal threading **39** to attach to corresponding threading **81** provided on power shaft **30** to retain radial bearings **44** and **46** and thrust bushing **48** intermediate retainer nut **38** and a shoulder **69** on power shaft **30** and shoulder **68** on control sleeve **12**, as seen in FIG. **4** (upper portion).

Power shaft **30**, control sleeve **12**, shoulder **68** and end **56** of lower radial bearing **46** define a blind annular space **55** intermediate exterior surface **33** of power shaft **30** and inner surface **34** of control sleeve **12**, blind annular space **55** having an upper end **45** defined by end **56** of lower radial bearing **46** and shoulder **68** of control sleeve **12**.

In an alternative embodiment, an annular seal (not shown) may be provided at end **56** of lower radial bearing **46** to define the upper end **45** of annular space **55**. An annular opening **54** of annular space **55** is defined intermediate control sleeve **12** and power shaft **30**.

At least one drive nozzle **52** extends through wall **31** of power shaft **30**. In an exemplary embodiment, at least two drive nozzles **52** are provided spaced within wall **31** of power shaft **30**. Drive nozzles **52** are in fluid communication with the internal channel **66** of power shaft **30**.

Drive nozzles **52** are located intermediate annular opening **54** of annular space **55** and upper end **45** of annular space **55**. Drive nozzles **52** allow fluid flow from channel **66** to annular space **55**.

Drive nozzles **52** each have an axis DD, as seen in FIG. **3**C. Axes DD are each oriented angularly with respect to axis AA, the angle being acute in the direction of upper end **60** of power shaft **30** and obtuse with respect to the direction of the threaded lower connector **23**. Accordingly, drive nozzles **52** are each oriented rearward from a plane normal to axis AA at the interior opening **57** of each nozzle **52**. Such orientation provides a forward thrust from fluid escaping through nozzles **52**.

Referring to FIG. **3**C, axes DD of the drive nozzles **52** are each angled radially to allow fluid expulsion from nozzles **52** to provide rotational thrust in a desired direction. Specifically, the angle D' of each axis DD with respect to a plane passing through axis AA and shaft wall **31** at interior opening **57** is acute in relation to the plane.

In the exemplary embodiment shown, rotation nozzles **26** and drive nozzles **52** are depicted. In an alternative embodiment, not shown, ports may be provided without nozzles to achieve the results of the invention. The principles taught in this invention apply with ports used in lieu of rotation nozzles **26** or drive nozzles **52**.

Inner surface **34** of control sleeve **12** is spaced from exterior surface **33** of power shaft **30**. The extent of separation is gap **49**. In operation, fluid forced through internal channel **66** is expelled through drive nozzles **52**. Upon impinging inner surface **34**, a reactive force is incurred, thereby enhancing the rotation of power shaft **30**.

In an exemplary embodiment, gap **49** is in the range of 0.0381 cm to 0.0762 cm (0.015" to 0.030") for a tool having a nominal diameter in the range of 3.175 cm to 4.445 cm (1.25" to 1.75"). In an exemplary embodiment, gap **49** is in the range of 0.508 cm to 0.635 cm (0.20" to 0.25") for a tool having a nominal diameter in the range of 10.4775 cm to 12.065 cm (4.125" to 4.75"). Generally, gap **49** is effective in a range of ratios of gap **49** to nominal diameter of the control sleeve **12** (gap:sleeve diameter) as follows: Ratio of 1:125 to ratio of 1:17. Depending on various application requirements, including the fluid used, nozzle size, pressure and other factors, ratios outside the foregoing range may be preferred.

Referring to FIGS. **2** and **4**, upper subassembly **16** comprises a generally hollow cylindrical body **61** having a connecting threading **82** for connecting to a drill string or tubing (not shown) at its upper end **80**, and connecting threading threaded lower end **42** for connecting to control sleeve **12** at control sleeve threading **19**. Upper subassembly **16** includes an interior channel **72** aligned with axis AA.

An injection tube **96** is provided in upper subassembly **16**. Injection tube **96** includes an elongated tube **40** and tube head **41**. Tube head **41** has a larger diameter than tube **40**. A tube retaining nut **86** is provided to retain tube head **41** between retaining nut **86** and a shoulder **87** provided in upper subassembly **16**. Retaining nut **86**, tube head **41** and tube **40** define a continuous tube channel **95** aligned with axis AA. Retaining nut **86** has connecting threading **84** for threaded connection to internal connecting threading **83** provided in upper subassembly **16**.

In an exemplary embodiment, injection tube **96** is retained in position by the retaining nut **86** and shoulder **87**. Injection tube **96** is free to rotate about axis AA independent of the rotation of power shaft **30** and upper subassembly **16**.

Upper subassembly **16** is provided with a cylindrical inset **88** at its lower end **62**. A thrust bushing **70** is provided to provide a bearing surface intermediate upper subassembly **16** and power shaft assembly **36**. Thrust bushing **70** additionally encloses and provides radial support for tube **40**.

Tube **40** extends past the lower end **62** of upper subassembly **16** into the channel **66** of power shaft **30**.

The interior surface **71** of thrust bushing **70** is sized and constructed to encircle the exterior surface **43** of tube **40** but to allow rotation between the surfaces. Thrust bushing **70** further contains a flange **74** extending radially outward. Flange **74** is received between the lower end **62** of upper subassembly **16** and upper end **60** of power shaft **30**. Thrust bushing **70** includes a cylindrical inset **78** to receive a segment of power shaft **30** at the upper end **60** of power shaft **30**. Cylindrical inset **78** is sized and constructed to slidably receive end **60** of power shaft **30**.

The diameter of outer surface **43** of injection tube **96** is preferably only slightly smaller than the diameter of channel **66** allowing injection tube **96** to be slidably received in channel **66**.

In an exemplary embodiment of the present invention, the injection tube **96** with a tube wall **90** having a width such that the wall will expand slightly when an appropriate operating pressure is applied internal of wall **90** in tube channel **95**. Such slight expansion creates a seal between the exterior surface **43** of tube wall **90** and the interior surface **93** of power shaft **30** that defines channel **66**.

In an exemplary embodiment, the tube wall **90** is provided with a slight flare proximate its lower end **64** to enhance sealing of tube wall **90** and the interior surface **93**. A preferred flare angle is up to five degrees outwardly from the tube wall segment that is not flared.

In summary, the power shaft assembly **36** is fixedly attached to the drill bit **20**. Power shaft assembly **36** is rotatable within control sleeve **12**. A blind annular space **55** is defined between power shaft **30** and control sleeve **12**.

In operation, jet motor **10** of the present invention is attached to a drill string or tube (not shown). A fluid (drilling fluid or gas) is introduced into the drill string or tube at determined pressures. Pressure is applied to the fluid forcing the fluid through aligned channels **72**, **95**, **66** and **22**. The fluid is forced through drive nozzles **52**, rotation nozzles **26** and cutting nozzles **28**. The pressure from the fluid in channels **66** and **22** is greater than the ambient downhole pressure. Differential pressure at rotation nozzles **26** and drive nozzles **52** create rotational torque on the drill bit **20** and power shaft **30**.

Importantly, the proximity of inner surface **34** of control sleeve **12** provides a surface that is stationary relative to power shaft **30**. The expansive force of the fluid escaping drive nozzles **52** impinging surface **34** enhances the rotational torque on power shaft **30**.

Gap **49** may be determined to provide desired reactive force of fluid expelled through drive nozzles **52** at inner surface **34**. In addition, the force of the drilling fluid may be manipulated in order to control the thrust of the drilling fluid against the sleeve inner surface **34** through the drive nozzle **52** thereby controlling the rotation of the power shaft **30** and the drill bit **20**.

As the drive nozzles **52** are located intermediate opening **54** of annular space **55** and upper end **45**, fluid forced out of drive nozzles **52** is forced out of opening **54**, thereby continually washing annular space **55** and preventing accumulation of debris in annular space **55**.

FIG. **5** depicts an alternative exemplary embodiment wherein four drive nozzles **52** are located on power shaft **30** in order to increase the amount of fluid expelled through the drive nozzles **52**. Drive nozzles **52** are depicted as symmetrically situated opposing pairs with respect to each other. Drive nozzles **52** may also be situated asymmetrically or in any combination of the two.

In an exemplary embodiment, an appropriate gas, such as nitrogen, may be utilized as the fluid medium. The construction of the present invention, particularly the construction of injection tube wall **90** with expansion capability upon application of appropriate fluid pressure in tube channel **95** together with fit of exterior surface **43** of tube wall **90** and the interior surface **93** of power shaft **30** allows the creation of an effective seal even though the fluid is a gas.

The exemplary embodiment providing a flared lower end **64** of tube wall **90** provides an effective seal at interior surface **93** as internal fluid pressure is applied at the open end of lower end **64**.

The foregoing description of the invention illustrates a preferred embodiment thereof. Various changes may be made in the details of the illustrated construction within the scope of the appended claims without departing from the true spirit of the invention. The present invention should only be limited by the claims and their equivalents.

I claim:

1. A motor for a downhole tool comprising:
a cylindrical control sleeve;
a power shaft;
said power shaft at least partially surrounded by said control sleeve;
said power shaft rotatable in relation to said control sleeve;
said power shaft having a power shaft wall;
said power shaft having an interior power shaft channel;
at least one opening provided in said power shaft wall;
said at least one opening in fluid communication with said power shaft channel;
said control sleeve having an interior control sleeve surface;
said at least one opening in said shaft wall having an opening axis;
said opening axis oriented toward said control sleeve surface;
said power shaft having a power shaft axis and upper and lower ends;
said opening axis of said at least one opening in said power shaft wall acutely oriented in relation to the direction of the upper end of said power shaft, and obtusely oriented in relation to the lower end thereof;
said at least one opening having an interior opening;
said opening axis of said at least one opening in said power shaft wall acutely oriented with respect to a plane passing through said power shaft axis and said power shaft wall at said interior opening;
said control sleeve connected to an upper subassembly;
said upper subassembly connectable to a drill string; said upper subassembly having an interior upper channel;
an injection tube providing fluid communication from said interior upper channel to said power shaft channel;

said injection tube comprising a tube head and a tube;

said tube head disposed within said upper subassembly;

said tube extending into said power shaft channel; and

wherein said injection tube having a lower tube end and an opposite upper tube end, wherein said injection tube is connected to said upper subassembly at said upper tube end.

2. The motor of claim 1, further comprising:

said control sleeve and said power shaft defining an annulus;

said at least one opening in said shaft wall having an opening outlet;

said annulus having an annulus closed end and an annulus open end;

said opening outlet is intermediate said annulus closed end and said annulus open end; and

said annulus having a uniform annulus gap between said annulus closed end and said annulus open end.

3. The motor of claim 2, further comprising:

said power shaft having an interior power shaft surface;

said injection tube having an exterior tube surface;

said tube slidably received in said power shaft channel;

said injection tube constructed to expand at a predetermined pressure; and

wherein said exterior tube surface, at said lower tube end, forms a seal against said interior power shaft surface upon application of a predetermined pressure.

4. The motor of claim 1, further comprising:

a drill bit operationally connected to said power shaft;

said drill bit having a cylinder wall;

said drill bit having a longitudinal drill bit axis;

at least one drill bit opening provided in said cylinder wall;

said at least one drill bit opening having an opening axis;

said opening axis of said at least one drill bit opening in said cylinder wall acutely oriented in relation to the direction of the upper end of said power shaft;

said at least one drill bit opening having an interior opening; and

said opening axis of said at least one drill bit opening in said cylinder wall acutely oriented with respect to a plane passing through said drill bit axis and said cylinder wall at said interior opening.

5. The motor of claim 1, further comprising:

said power shaft having an interior power shaft surface;

said injection tube having an exterior tube surface;

said injection tube constructed to expand at a predetermined pressure; and

wherein said exterior tube surface, at said lower tube end, forms a seal against said interior power shaft surface upon application of a predetermined pressure.

6. The motor of claim 5, further comprising:

said injection tube having a flared opening proximate said lower tube end; and

said lower tube end received in said power shaft channel proximate said power shaft surface.

7. The motor of claim 1, wherein said at least one opening provided in said shaft wall comprising a nozzle.

8. A motor for a downhole tool comprising:

a cylindrical control sleeve;

a power shaft;

said power shaft at least partially surrounded by said control sleeve;

said power shaft rotatable in relation to said control sleeve;

said power shaft having a power shaft wall;

said power shaft having an interior power shaft channel;

at least one nozzle provided in said power shaft wall;

said at least one nozzle in fluid communication with said power shaft channel;

said control sleeve having an interior control sleeve surface;

said at least one nozzle having a nozzle axis;

said nozzle axis oriented toward said control sleeve surface;

said control sleeve connected to an upper subassembly;

said upper subassembly having an interior upper channel;

an injection tube providing fluid communication from said upper channel to said power shaft channel;

said power shaft having an interior power shaft surface;

said injection tube having a lower tube end and an opposite upper tube end and an exterior tube surface;

said injection tube constructed to expand at a predetermined pressure;

wherein said exterior tube surface, at said lower tube end, forms a seal against said interior power shaft surface upon application of a predetermined pressure;

said control sleeve and said power shaft defining an annulus;

said annulus having an annulus closed end and an annulus open end;

said at least one nozzle having a nozzle outlet;

said nozzle outlet intermediate said annulus closed end and said annulus open end; and

said annulus having a uniform annulus gap between said annulus closed end and said annulus open end.

9. The motor of claim 8, further comprising:

said power shaft having a power shaft axis and an upper end and a lower end;

said nozzle axis of said at least one nozzle in said power shaft wall acutely oriented in relation to the direction of said upper end of said power shaft, and obtusely oriented in relation to said lower end of said power shaft;

said at least one nozzle having an interior opening; and

said nozzle axis of said at least one nozzle in said power shaft wall acutely oriented with respect to a plane passing through said power shaft axis and said power shaft wall at said interior opening.

10. The motor of claim 8, further comprising:

said upper subassembly connectable to a drill string;

a drill bit operationally connected to said power shaft;

said power shaft having an upper end and a lower end;

said drill bit having a cylinder wall;

said drill bit having a longitudinal drill bit axis;

at least one drill bit opening provided in said cylinder wall;

said at least one drill bit opening having an opening axis; and

said opening axis of said at least one drill bit opening in said cylinder wall acutely oriented in relation to the direction of the upper end of said power shaft.

11. The motor of claim 10, further comprising:

said injection tube comprising a tube head and a tube;

said tube head in said upper subassembly;

said tube extending into said power shaft channel;

said tube slidably received in said power shaft channel; and

said injection tube connected to said upper subassembly.

12. The motor of claim 11, further comprising:

said injection tube independently rotatable in relation to said upper subassembly; and

said injection tube independently rotatable in relation to said power shaft.

13. The motor of claim **12**, further comprising:
said tube having a flared opening proximate said lower tube end; and
said lower tube end received in said power shaft channel proximate said power shaft surface.

14. The motor of claim **8**, further comprising:
a drill bit operationally connected to said power shaft;
said drill bit having a cylinder wall;
said drill bit having a longitudinal drill bit axis;
at least one drill bit opening provided in said cylinder wall;
said at least one drill bit opening having an opening axis;
said at least one drill bit opening having an interior opening; and
said opening axis of said at least one drill bit opening in said cylinder wall acutely oriented with respect to a plane passing through said drill bit axis and said cylinder wall at said interior opening.

15. A motor for a downhole tool comprising:
a cylindrical control sleeve;
a power shaft;
said power shaft at least partially surrounded by said control sleeve;
said power shaft rotatable in relation to said control sleeve;
said power shaft having a power shaft wall;
said power shaft having an interior power shaft channel;
at least one nozzle provided in said power shaft wall;
said at least one nozzle in fluid communication with said power shaft channel;
said control sleeve having an interior control sleeve surface;
said at least one nozzle having a nozzle axis;
said nozzle axis oriented toward said control sleeve surface;
said control sleeve connected to an upper subassembly;
said upper subassembly having an interior upper channel;
an injection tube providing fluid communication from said upper channel to said power shaft channel;
said power shaft having an interior power shaft surface;
said injection tube having a lower tube end and an opposite upper tube end;
said injection tube having a flared opening proximate said lower tube end; and
said lower tube end received in said power shaft channel proximate said power shaft surface.

16. The motor of claim **15**, further comprising:
said power shaft having an upper end and a lower end;
said nozzle axis of said at least one nozzle in said shaft wall acutely oriented in relation to the direction of said upper end of said power shaft, and obtusely oriented in relation to said lower end of said power shaft;
said at least one nozzle having an interior opening;
said nozzle axis of said at least one nozzle in said power shaft wall acutely oriented with respect to a plane passing through said power shaft axis and said power shaft wall at said interior opening;
a drill bit operationally connected to said power shaft;
said drill bit having a cylinder wall;
said drill bit having a longitudinal drill bit axis;
at least one drill bit nozzle provided in said cylinder wall;
said at least one drill bit nozzle having a drill bit nozzle axis;
said drill bit nozzle axis of said at least one drill bit nozzle in said cylinder wall acutely oriented in relation to the direction of the upper end of said power shaft;
said at least one drill bit nozzle having a drill bit nozzle interior opening; and
said drill bit nozzle axis of said at least one drill bit nozzle in said cylinder wall acutely oriented with respect to a plane passing through said drill bit axis and said cylinder wall at said drill bit nozzle interior opening.

17. The motor of claim **15**, further comprising:
said control sleeve and said power shaft defining an annulus;
said annulus having an annulus closed end and an annulus open end;
said at least one nozzle having a nozzle outlet;
said nozzle outlet intermediate said annulus closed end and said annulus open end; and
said annulus having a uniform annulus gap between said annulus closed end and said annulus open end.

18. The motor of claim **17**, further comprising:
said injection tube having an exterior tube surface and said injection tube constructed to expand at a predetermined pressure; and
wherein said exterior tube surface, at said lower tube end, forms a seal against said interior power shaft surface upon application of a predetermined pressure.

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